

University of Arkansas, Fayetteville
ScholarWorks@UARK

Agricultural Education, Communications and
Technology Undergraduate Honors Theses


Agricultural Education, Communications and
Technology

5-2018

Agricultural Information Needs and Food Access in the Stann Creek District of Belize

Sam Harris

Follow this and additional works at: <http://scholarworks.uark.edu/aectuht>

 Part of the [Agribusiness Commons](#), [Agricultural Economics Commons](#), [Agricultural Education Commons](#), [Communication Technology and New Media Commons](#), [Community-Based Learning Commons](#), [Community-Based Research Commons](#), [Food Security Commons](#), [International and Intercultural Communication Commons](#), and the [Rural Sociology Commons](#)

Recommended Citation

Harris, Sam, "Agricultural Information Needs and Food Access in the Stann Creek District of Belize" (2018). *Agricultural Education, Communications and Technology Undergraduate Honors Theses*. 6.
<http://scholarworks.uark.edu/aectuht/6>

This Thesis is brought to you for free and open access by the Agricultural Education, Communications and Technology at ScholarWorks@UARK. It has been accepted for inclusion in Agricultural Education, Communications and Technology Undergraduate Honors Theses by an authorized administrator of ScholarWorks@UARK. For more information, please contact scholar@uark.edu, ccmiddle@uark.edu.

Agricultural Information Needs and Food Access in the Stann Creek District of Belize

A thesis submitted in partial fulfillment
of the requirements for the Bachelor of Science in degree
in Agricultural Business

Honors Program

Sam Harris

May 2018

University of Arkansas

Donna L. Graham, Ph.D.
Thesis Director

Amy L. Farmer, Ph.D.
Committee Member

Jennie Popp, Ph.D.
Committee Member

Don Edgar, Ph.D.
Committee Member

Acknowledgment

I would first like to thank my thesis advisor Dr. Donna L. Graham of the Dale Bumpers College of Agricultural, Food and Life Sciences at the University of Arkansas. Her guidance throughout this process has proved invaluable and has allowed me to grow both personally and academically.

Next, I want to extend my thanks to the rest of my defense committee: Drs. Jennie Popp, Amy L. Farmer, and Don Edgar. Without their passionate participation and input, the study could not have been successfully conducted.

I would also like to express my sincere appreciation to the Belize Ministry of Agriculture for their assistance in collecting data and executing the research within the timeframe of which the study was conducted. Specifically, I would like to thank Mr. Marvin Blades for his mentorship and supervision while spending time in Stann Creek.

Finally, I would like to thank the rest of the faculty at the University of Arkansas for their support throughout this capstone process. Without the funding and support of the Honors College, I would not have been able to carry out this endeavor and successfully complete this thesis.

Sincerely,

Sam Harris

Table of Contents

Abstract	1
Introduction and Background	2
Literature Review.....	4
Problem Statement.....	7
Purpose and Objectives.....	8
Methodology	9
Results	12
Discussion and Recommendations	27
References.....	35
Appendix I: IRB Approval.....	38
Appendix II: Farmer Survey	39
Appendix III: General Public Survey	44

Abstract

The purpose of this study was to describe agricultural information sources available to farmers and to describe food access and availability for the people of Dangriga, Stann Creek, Belize. This study used descriptive survey research methods with convenience sampling of the general public (n=22) and of farmers (n = 38) in the summer of 2017. Farmers use a variety of agricultural information sources with the extension service cited most often, followed by friends and fellow farmers. Weather, lack of information, pests, and inadequate access to capital were of primary concern for farmers. Face to face meetings were used most often by extension officers for disseminating agricultural information. Smallholder farmers and the general public have very similar levels of food access and availability. Using the Food Insecurity Experience Scale, developed by the Food and Agriculture Organization (FAO), minimal difference was found between what the smallholder farmers and the general public selected for household food consumption. Both groups reported mild food insecurity, while a few individual respondents reported severe food insecurity. Recommendations of the study focused on practical operational strategies for the local Department of Agriculture, as well as the Belize Ministry of Agriculture. Additionally, development experts and nutrition specialists should review the results and findings and identify what can be done to further eradicate hunger and increase overall food access and availability throughout Belize.

Introduction and Background

Located on the Caribbean coast of Central America, the country of Belize spans over 8,764 square miles and is home to over 377,000 people (United Nations Development Programme [UNDP], n.d.). Belize has a small, essentially private enterprise economy that is based primarily on agriculture, agro-based industry, and merchandising, with tourism and construction recently assuming greater importance (UNDP, n.d.). Sugar, the chief crop, accounts for nearly half of exports, while the banana industry is the country's largest employer. Trade is a vital part of Belize's economy with major trade agreements with the United States, Mexico, the European Union, and Central America (UNDP, n.d.). The government in Belize faces various problems to the development and economic progress. Infrastructure continues to be a huge challenge for poverty reduction and development (UNDP, n.d.).

Agriculture employs over one-third of Belize's workforce, playing a vital part in the economy and accounting for over 23 percent of the nation's GDP. As 60% of the country is covered in forest, large-scale agricultural production involving bananas, sugar cane, and citrus occur in the low-lying areas of the country. With trade preference given to certain countries such as the United States and Mexico, sugar cane is the nation's largest agricultural export, consequently accounting for nearly half of all arable land use (UNDP, n.d.). Elsewhere, small-scale operations exist across the country, with the majority being subsistence farming. A recent census of farming in Belize shows that 74 percent of farms in the country are less than 20 hectares (~49 acres), meaning local families operate most farms in remote parts of the country (UNDP, n.d.).

Forty one percent of the country's population lives in poverty, with a per capita income of \$4,681 (Statistic of the Nation, 2017). Much of this population is involved in agricultural

production, either farming for themselves or working for wages (Agriculture Department, n.d.). The National Poverty Assessment of 2002 indicated that Belize's agricultural workers are poorer than non-agricultural laborers, resulting in many of them seeking alternative employment away from the farm (Statistic of the Nation, 2017). Smallholder farmers are often poor for a variety of reasons. First, most rural producers practice farming for subsistence only, using very little technology due to their lack of resources and information. As a result, their levels of production are very low (Rural Poverty in Belize, n.d.). Traditionally, farmers that receive technical support from private or public entities produce more and profit more; however, agricultural research and extension services have been reduced over the past two decades (Obidike, 2011). When rural farmers lack access to knowledge and information that would help them achieve maximum agricultural yield, they seek types of employment off of the farm for survival (Munyua, 2000).

Blait, Calvelo Rios, and Masias (1996) pointed out that the least expensive input for improved rural agricultural development is adequate access to knowledge and information in areas of new agricultural technologies, early warning systems (drought, pests, diseases, etc.), improved seedlings, fertilizer, credit, market prices, etc. However, there have been shortcomings of traditional print and library based methods providing agricultural information to rural farmers who are largely illiterate and relatively removed from formal sources of information such as extension stations and libraries (Van and Fortier, 2000). Additionally, the supply of rural financial services has been quite limited until the present, and it has been particularly difficult for poor rural people to access them (Rural Poverty in Belize, n.d.). As the poverty rate continues to rise due to adverse economic conditions, climate change, and corporatization of smallholder farms, the prevalence of food insecurity also rises across Belize (Rural Poverty in Belize, n.d.). The United Nations Millennium Development Goals (MDG), in particular, the goal, "Eradicate

extreme poverty and hunger,” brought attention to many of these issues and spurred development of programs aimed at addressing them. Presently, the country of Belize is off-target at achieving the MDG goal (MDG Monitor, 2016). Due to the country’s small size and population, little research exists regarding food availability, especially protein sources, as well as the common sources of agricultural information that rural farmers are most likely to access for improving production practices.

Literature Review

Information Barriers and Access

The access to and use of agricultural information is a key factor to improving agricultural production in any country (Nxumalo & Oladele, 2013). The lack of education and access to information is frequently a limiting factor to agricultural development, especially in developing countries like Belize (FAO, n.d.). The FAO emphasizes the importance of information access as farms and agricultural operations have intensified and become more complex with the emergence of industrialized farm technologies. Aonngerthayakorn and Pongquan (2016) noted that fellow farmers are perceived as the most preferred source of agricultural information by 40.8% of farmers, while approximately 25.0% of farmers preferred extension officers and similar sources. Fellow farmers are likely sources of information in rural, agricultural communities because they foster a sense of solidarity and reduce the need and desire to compete against larger market forces (Kipkurgat, 2015). Contrary to the findings of previous studies, Ogunleye, and Abidogun (2014) cited that information sources most commonly used by farmers include television, mobile phones, and radio broadcasts.

Extension plays an important role in providing food and fuel for the world's most densely populated areas (Bartholomew, 1994). Extension education and access to extension officers are vital in many developing countries by providing a major role in disseminating technologies generated by the public sector (Meagy, 2013). In his study on the effectiveness of farmer information needs, Meagy (2013) found increased contact with extension personnel and increased agricultural knowledge were the most effective methods in resolving farmer concerns. The field extension agent is the most effective person or means in agricultural motivation according to Rajaguru and Satapathy (1971). In early studies of effective technology transfer, Tripathy and Panday (1967) found that methods like personal contact, demonstration, group discussion, and literature were the most effective methods used by the extension service for information transfer, whereas radio programs, film shows, and meetings were not as effective. Suryanarayana (1990) found that farmers that had access to extension education were effective in disseminating information to other farmers. Studies have shown that insufficient access to agricultural information has been a barrier to improving agricultural production (Zellaya, Harder, & Roberts 2016; Obidike 2011). When farmers do not have access to technical knowledge and skills to increase production, they are not always able to achieve maximum yield since low yields are often a result of technical constraints or barriers faced by producers (Godfray et al., 2010).

Food Security & Food Access

The FAO (2014) found that research on food insecurity revealed:

...the experience of food insecurity is characterized by the uncertainty and anxiety regarding food access and change in the quality of the diet, such as a less balanced, more monotonous diet. With increasing severity, the quantity of food consumed

decreased as portion sizes are reduced, meals are skipped and at its most severe, people are forced to go without eating (p.5).

A review of twenty studies around the world by the FAO (2014) concluded that these dimensions of the experience of food insecurity appear to be common across cultures. A person(s) is food insecure when he or she does not have access to enough food for an active, healthy life (Smith, El Obeid, & Jenson, 2000). Furthermore, a household is considered food secure when their food supply is sufficient, secure, and sustainable (Maxwell, 1996). Smith, El Obeid, and Jensen (2000) also records the causes of food insecurity as multifaceted. These factors include political instability, inadequate education, population growth, and macroeconomic imbalance. Ultimately, all factors can be summarized by two general causes: insufficient national food availability and insufficient access to food by individuals and households. Frankenberger (1996) explained that households gain access to food by either (1) the production or gathering of food, (2) purchasing food from the local or global supply market, or (3) in-kind transfers of food from governments, NGOs, individuals or other institutions of aid. Within individual households, access to food is determined by intra household food distribution decisions. Connecting poverty to food insecurity, researchers claim an individual or household can be considered in absolute poverty when unable to meet all basic needs (Frankenberger, 1996).

Not only does food access and availability have implications for hunger in rural communities, but it also is a large indicator of health and wellbeing. Various studies have examined the relationship between food availability and access and dietary intake. Better access to large grocery stores or supermarkets correlate to healthier food intakes (Larson et al., 2009). Furthermore, Chen et al., (2009) found that proximity to grocery stores had a small negative

effect on body mass index (BMI). In less severe instances of food insecurity, household food managers or providers sacrifice food quality for quantity to prevent household members, especially children, from being hungry. Ultimately, less expensive filling foods are more energy dense and nutrient deficient, whereas healthier foods are normally far more expensive and less accessible (Cook & Frank, 2008).

Problem Statement

Agricultural development is closely tied to poverty reduction (World Development Report, 2008). Adequate rural development leads to effective and efficient agricultural systems to supply food and animal protein (Obidike, 2011). Seventy four percent of farms in Belize are considered smallholder farms, farming 20 hectares (49 acres) or less (United Nations Development Programme, n.d.). With changing market demands and global competition in agriculture, it is more important than ever for smallholder farmers to have access to adequate and quality information involving best-practices for production agriculture (World Food Programme [WFP], 2015). With sugar cane being the country's main export, extension services or other governmental resources often target exclusively to sugar cane producers, leaving smallholder farmers producing citrus and other staple crops in coastal, lowland areas like Dangriga and depending on local or indigenous knowledge or traditional methods of farming practices. Consequently, rural smallholder farmers may not be able to produce enough food for their families or local community due to constraints of access to timely and up-to-date information.

Purpose and Objectives

The purpose of this study was to describe agricultural information sources available to farmers and to describe food access and availability for the people of Dangriga, Belize.

Throughout this study, the terms food access and food availability will be used to refer to the sufficient supply and equitable distribution of food, respectively.

The research objectives were to:

1. Identify what information sources farmers utilize for agricultural knowledge.
2. Identify the food production concerns or barriers faced by farmers in Stann Creek.
3. Describe food security regarding food availability and access for farmers and the general public.
4. Determine community interest and opportunities for future small agricultural operations for farming and non-farming families.

Significance of the Study

This study has potential significance for government officials and smallholder farmers, as well as private stakeholders. In an area where the poverty rate is steadily rising and where farming is the main income source for most families, it is important to address how information regarding best practices, changing consumer demands, and new technology is being disseminated to farmers in Stann Creek. Understanding the barriers that exist and what methods for spreading information work most effectively allow for recommendations to be made to the experts in Belize who are responsible for agricultural extension, education, and outreach. With these constraints being identified and addressed, smallholder farmers will be better suited to meet future challenges, increasing the likelihood that they remain in production agriculture and that

they can meet the dietary needs of their family through farming. Hunger and poverty reduction require that the incomes of economically disadvantaged people and the sources from which they derive their livelihoods be enhanced (FAO, n.d.). Overall, closing the gaps in the distribution of vital information to smallholder farmers will result in a more productive economy and less malnourished, food-insecure people. With the instability of the agriculture industry and changing demands of domestic and international markets, it is vital that farmers in all regions of the country have access to agricultural resources and development opportunities that spur productivity and sustain essential farm operations (WFP, 2015).

Methodology

This study used a descriptive survey research design to gather data to describe the population and phenomenon being studied. The approach involved both quantitative and qualitative data collection methods through face to face interviews and observation with the goal of describing the participant's experiences in a specific context. This study sought to understand the status of smallholder farmers in accessing agricultural information and the level of food insecurity of farmers and the general public in Stann Creek, Belize. The data collected was based on a convenience sample of smallholder farmers and the general public. Initial contact for the study occurred during the summer of 2017 arranged by Peacework and the Belize Ministry of Agriculture Department.

For the contact with the smallholder farmers, the researcher attended various cooperative meetings across the district with extension officers and visited farmers engaged in a variety of production areas. Traveling across the region allowed for collecting data and anecdotal evidence about food security needs and farmer concerns, while allowing the researcher to better

understand each observation. With the help of the Extension Division in Stann Creek and the approval of various village chiefs in Mayan areas, the researcher was able to interview various farming households within the village. In areas where farm operations were more geographically widespread, town leaders often assisted by gathering local farmers for monthly cooperative meetings, allowing the researcher to administer the surveys. These approaches helped the researcher to understand the phenomena in the natural setting of the farmers. During the administration of each survey, the researcher informed each respondent of the privacy policies protecting their responses as noted in the policies and statement approved by the University of Arkansas Institutional Review Board. After clarifying the purpose of the study, each question was read aloud to the respondent to allow for uniformity. The instrument questions were presented in chronological order and responses were collected manually on paper as they were reported. The survey responses were clarified by the researcher and stored until ready for analysis.

The general public survey data was collected via on the street interviews in Dangriga Town (Stann Creek District). The individuals contacted were explained the nature of the research and informed of the privacy policies if they consented to participate in the survey. Each question was read aloud and presented in chronological order. The responses were recorded on paper as they were given. The researcher then clarified the survey responses and stored until ready for analysis.

Instrumentation

Two forms of instruments administered in face-to-face interviews were used for data collection in this study. The General Public instrument consisted of a series of 24 questions

directed toward measuring food security in Dangriga, as well as the demographics of the public interviewed. The second survey, the Farmer Questionnaire, consisted of 28 questions that directly targeted the access to agricultural information that exists and how farmers in Stann Creek utilize these outlets. The content covered central themes including farmer demographics, agricultural background, production barriers and information access. While the General Public questionnaire did not seek to understand production practices or farm management techniques, both of the instruments included the Food Insecurity Experience Scale (FIES) developed by the Food Agricultural Organization (FAO) to gauge food security and access. This instrument has been accepted by the United Nations as a valid and reliable measure of food insecurity (FAO, 2017). Each FIES question refers to a different experience and is associated with a different level of severity of food insecurity. It is unique in that it considers diet quality, reduced food quantity and psychosocial elements associated with anxiety or uncertainty regarding the ability to procure enough food (FAO, n.d.).

The FIES instrument consists of eight questions that focus on food-related behaviors and experiences associated with accessing food due to resource constraints. The responses measure mild to severe food insecurity. The responses helped describe levels of food insecurity and can be illustrated on a scale as presented in figure 1.

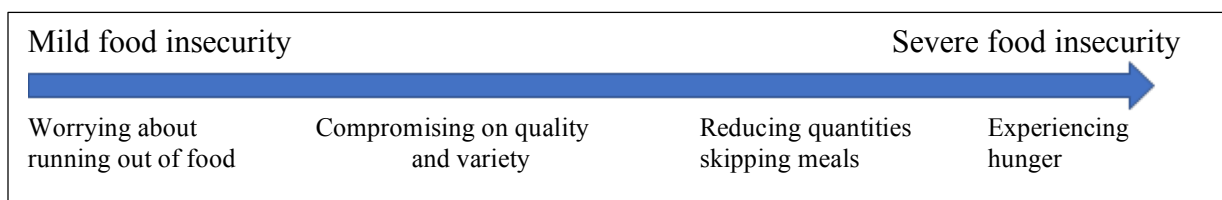


Figure 1: Scale of food insecurity severity

The questions used with both instruments for this study were modified from a similar study by Zelaya, Harder, and Roberts (2016). Both instruments were originally developed using relevant data and literature review. Additionally, a panel of experts from the University of

Arkansas approved the content of the instrument, and the instrument received institutional approval (IRB # 17-05-691). Both instruments were assessed to measure the simplicity and use of the questionnaire. In this study, the questions were modified to fit the context of Belize, specifically the Stann Creek District, and structured to collect additional data and pursue further lines of questioning. The instrument included open-ended and close-ended questions, which created a semi-structured interview while allowing for participants to add relevant information not originally included in the interview guide.

Results

Population

The population for this study, including the farmers and the general public, was all adults from the Stann Creek District in Belize. Specifically, most respondents reside in the coastal town of Dangriga, Belize. Stann Creek is one of four districts in the country. For the general public respondents ($n = 22$), 63.6% were females and 36.4% were males. The majority (63.0%) of these individuals had lived in Stann Creek for over 20 years, but 27.1% had moved to the area and lived there less than 10 years. The number living in their household ranged from one to over 11 with the majority (59.1%) having 6-10 members in their household. Over 63.6% of residents had received at least a high school diploma. Of the general public respondents, most were 40-49 years of age (27.3%), but there was a fairly equal distribution of all ages, young and old. Most respondents were laborers (36.4%) or self-employed (27.3%). All demographics of the general public are found in Table 1.

Table 1

Demographics of the General Public (n = 22)

Variable		<i>f</i>	%
Gender	Male	8	36.4
	Female	14	63.6
Age	Under 20 years	2	9.1
	20-29 years	4	18.2
	30-39 years	4	18.2
	40-49 years	6	27.3
	50-59 years	4	18.2
	60-69 years	0	0.0
	70-79 years	2	9.1
Education	Post-Secondary	6	27.3
	High School	14	63.6
	Primary	2	9.1
Size of Household	1-5 members	8	36.4
	6-10 members	13	59.1
	Over 11 members	1	4.5
Length of Time Living in Stann Creek	Less than 10 years	6	27.1
	10-19 years	2	9.0
	20-29 years	3	13.5
	30-39 years	1	4.5
	40-49 years	5	22.5
	50-59 years	4	18.0
	More than 60 years	1	4.5
Source of Income	No Income	4	18.2
	Laborer	8	36.4
	Family	3	13.6
	Education	1	4.5
	Self-Employed	6	27.3

Smallholder Farmers

For the local farmers ($n = 38$), 92.1% of the farmers were male (Table 2) with 47.4% between the ages of 40 and 59 years of age. An equal number of the farmers was under 30 years old or over the age of 60 years representing 26.3% each of the respondents. There was variation in the education of the farmers with a majority (57.9%) having a high school (34.2%) or post-secondary education (23.7%). However, there was another 31.6% with primary education and

7.9% who did not have any level of education. Families varied in size with households ranging from 1-3 members (36.8%); 4-6 members (39.5%) and 23.7% having over seven members living in the household. Some 28.9 % reported being engaged in farming less than 10 years, but 68.4 % of the farmers surveyed had been farming over 11 years. Interestingly, over 31.6% of farmers reported farming for 31 years or more.

Table 2

Demographics of the Smallholder Farmer Respondents (n = 38)

Variable		<i>f</i>	%
Gender	Male	35	92.1
	Female	3	7.9
Age	24-29 years	10	26.3
	40-59 years	18	47.4
	>60 years	10	26.3
Education	Post-Secondary	9	23.7
	High School	13	34.2
	Primary	12	31.6
	No Education	3	7.9
	Missing	1	2.6
Size of Household	1-3 members	14	36.8
	4-6 members	15	39.5
	Over 7 members	9	23.7
Length of Time Farming	1-10 years	11	28.9
	11-30 years	14	36.8
	>31 years	12	31.6
	Missing	1	2.6
Depend on Income from Farming	Total Dependence	16	42.1
	Partial Dependence	18	47.4
	Missing	4	10.5

Farmers ($n = 34$) were asked whether their crop or livestock operation was the total source of income for the family to understand how big of a role farm production plays in their lives. Surprising, while only full-time producers were included in this population, only 42.1% reported that their entire income stream was a result of production agriculture (Table 2).

Otherwise, farmers depend on income from other members of the family which are often employed in fields of general labor, education, and transportation.

Objective 1: Identify what information sources farmers utilize for agricultural knowledge

To discover what information sources farmers were utilizing in Stann Creek, farmers were asked what information sources they used regarding their operation. This question allowed for a better understanding as to what farmers rely on when issues arise with their farm.

Respondents were able to choose from 15 choices including media sources (radio, television, the Internet), print materials (leaflets/pamphlets, newsletters), or face to face contacts, (extension workers and/or trainings), and sources of information (libraries, governmental organizations, non-governmental organizations (NGOs), friends, family, input service providers, schools, other sources) or none (farmers rely on their own personal expertise). The farmers (n=38) were able to provide more than one response as indicated in Table 3. Over 20.0% of farmers report that they rely on extension workers or the Ministry of Agriculture on-farm training seminars, while slightly over 17.0% report that they also get information from friends and surrounding farmers in the area. The radio, Internet, and family members were each reported as an information source by more than 10 percent of respondents. All sources are reported in Table 3.

Table 3

Information Sources Used for Agricultural Information (n = 38)

<i>Source</i>	<i>f</i>	<i>%</i>
Radio	9	12.0
Television	4	5.3
Leaflets, Pamphlets	4	5.3
Newsletters	5	6.7
Internet	8	10.7
Extension Workers or Training	15	20.0
Library	2	2.6
Governmental Organizations	1	1.3
NGOs	2	2.7
Friends	13	17.3
Family Members	8	10.7
Input Service Providers	1	1.3
Schools	0	0.0
Other	2	2.7
None, rely on personal expertise	1	1.3

To understand how technology had infiltrated into the Stann Creek area, farmers ($n = 38$) were asked whether or not they had begun using any new technology on their farm within the last 10 years of production. Over 70.0% of farmers indicated they had not implemented any new technologies into their operations, but for the 28.9% ($n = 11$) of the farmers who had added some new technology, the source of learning about this technology was from mass media (57.9%). The extension officers were the least frequently cited source for learning about new technology with only one farmer (5.9%) indicating he had learned about technology from the extension officer. These responses are shown in Table 4.

Table 4

Source of Information About New Technology (<i>n</i> =17)		
Source	<i>f</i>	%
Extension	1	5.9
Media	11	64.7
Friends/Cooperative	3	17.6
Other	2	11.8

Objective 2: Identify the food production concerns or barriers faced by farmers in Stann Creek

While the Stann Creek District is well known for its production and distribution of fresh citrus, corporate citrus farms were excluded from this study to narrow the frame to smallholder farmers as the target of this study. Of the farmer respondents (*n* = 37), 56.8% maintained row crop operations, while over 35.1% reported operations with both row crops and animal production as shown in Table 5.

Of the row crop farmers, the majority of respondents reported rice as their main cash crop. Additionally, almost 29.0% of operations grew plantains, while 14.3% percent of the smallholder farmers included in the study privately grew citrus. Farmers were asked to identify their interest in diversifying or expanding their operations. Answers were used to determine if extension officers from the Ministry of Agriculture were addressing the interest of producers in expanding their operations and increasing productivity. For respondents that answered “No,” (*n*=10) as a follow up, they were asked what barriers keep them from expanding. Participants were able to pick from four options of money, time, space/land, or no perceived need to expand. Over 66.0% of farmers had considered expanding their operations while over 51.0% of them reported that capital was the largest barrier they faced to diversify (Table 5).

Table 5

<i>Characteristics of Farming Operations (n = 37)</i>		
<i>Type of Operation</i>	<i>f</i>	<i>%</i>
Crop	21	56.8
Animal	3	8.1
Both	13	35.1
<i>Types of Crops (n=35)</i>		
Rice	13	37.1
Beans	0	0.0
Nuts	0	0.0
Citrus	5	14.3
Coconut	1	2.9
Pineapple	2	5.7
Bananas	4	8.6
Plantains	10	28.6
Other	1	2.9
<i>Size of Operation (hectares) (n = 36)</i>		
1-9 hectares	17	47.2
10-29 hectares	11	30.6
>30 hectares	8	22.2

**Respondents were able to provide more than one response.*

To further understand Objective 2, farmers were asked to describe their major production concerns. The respondents had a choice from insect damage, disease, poor yield, weather, and finances. Responses were not limited to one answer to this question. While around 18.0% of farmers reported that weather and poor yield concerned their farm's livelihood, 32.6% reported that disease was the main concern with their production and financial issues was a concern for 28.3%.

Table 6

Production Concerns of Farm Operators in Belize (n = 38)

<i>Concern (n = 28)</i>	<i>f</i>	<i>%</i>
Insect Damage	2	4.4
Disease	15	32.6
Poor Yield	8	17.4
Weather	8	17.4
Financial	13	28.3
<i>Barriers to Expanding (n = 27)</i>		
Not Needed	2	7.4
Space/Land	6	22.2
Time	5	18.5
Money	14	52.0

**Respondents were able to provide more than one production concern(s)*

To identify production concerns, farmers ($n = 36$) were asked whether or not they had experienced an increase or decrease in production within the last five years. Over 55% of producers indicated that their farm productivity had decreased as opposed to increasing while 44.4% had increased. More than two-thirds indicated they had considered diversifying their crop or animal production to alleviate production decreases, but the financial means (51.9%) to diversify was listed as the main reason preventing this from occurring. Other barriers reported by the farmers included space for additional farming (22.2%), and time (18.5%).

Objective 3: Describe food security regarding food availability and access for farmers and the general public

To gauge food security regarding availability and access, as described in Objective 3, the general public and smallholder farmers were asked where they mainly obtained their food. The following options were provided: grocery store, farmers' market, local producers, or other sources. Respondents were asked to select whether they obtained all, most, some, or none of their food from each of those sources. A majority (54.5%) indicated that they got most of their

food from local grocery stores, but 72.7% use the farmer's market and 59.1% use local producers. In comparison, only 13.6% revealed that they got most of their food from farmers' markets, local producers, or other sources.

Table 7

Food Sources of the General Public (n=22)

	Grocery Store		Farmer's Market		Local Producers		Other	
Consumption	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	2	9.1	1	4.5	0	0.0	0	0.0
Most	12	54.5	2	9.1	0	0.0	1	4.5
Some	7	31.8	16	72.7	13	59.1	1	4.5
None	1	4.5	3	13.6	9	40.9	20	90.9
Total	22	100.0	22	100.0	22	100.0	22	100.0

Further investigating Objective 3, participants were asked how far local grocery sources were from their residence. Over 90.0% of respondents reported that grocery stores, farmers' markets, and local producers were all within one mile from their permanent residences.

Participants of this study were asked to identify what types of foods were purchased at each of the indicated sources. Individually, they were asked to gauge how much protein, dairy, bread/grains, and fruits/vegetables were purchased from each source. Responses ranged from all to none. As shown in Table 8, almost 55.0% of the public reported that they buy all or most of their protein foods from grocery stores. Similarly, 63.7% of all or most of all dairy products are purchased from local grocery stores. However, 81.0% of the local public shop for fruits and vegetables from farmer's markets while 59.1% indicated that they bought none of their family produce from local grocery stores or supermarkets. Breads/grains are purchased from all sources with 36.4% purchased from grocery stores. For respondents that reported getting food from local farmers' markets, 66.7% reported buying none of their protein foods from this source. Similarly, 85.71% bought none of their dairy producers from farmers' markets. As indicated in Table 7, the

majority of the general public indicated that they purchased some or none of their food from local producers in the Dangriga-area.

Table 8

Food Group Purchasing Behaviors of the General Public

<i>Purchased at Grocery Store (n = 22)</i>								
	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	9	40.9	12	54.5	1	27.3	1	4.5
Most	3	13.6	2	9.1	1	9.1	1	4.5
Some	7	31.8	8	31.8	12	54.5	7	31.8
None	3	13.6	1	4.5	2	9.1	13	59.1
Total	22	100.0	22	100.0	22	100.0	22	100.0

<i>Purchased at Farmers Market (n = 21)</i>								
	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	0	0.0	0	0.0	1	4.8	9	42.9
Most	1	4.8	0	0.0	4	19.1	8	38.1
Some	6	27.3	3	14.3	4	19.1	1	4.8
None	14	66.7	18	85.7	12	57.1	3	14.3
Total	21	100.0	21	100.0	21	100.0	21	100.0

<i>Purchased from Local Producers (n = 20)</i>								
	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	0	0.0	0	0.0	0	0.0	0	0.0
Most	0	0.0	0	0.0	0	0.0	0	0.0
Some	5	25.0	2	10.0	3	15.0	10	50.0
None	15	75.0	18	90.0	17	85.0	10	50.0
Total	20	100.0	22	100.0	22	100.0	22	100.0

Following the assessment of Objective 3, participants were asked whether or not meat (protein) was available each day to eat. Likewise, they were also then asked if fresh fruits and vegetables were available for consumption. Over 95.0% of the public reported having access to meat each day while 85.71% revealed that they had access to fresh fruits and vegetables.

To further gauge food security and access in Stann Creek to meet Objective 3, farmers ($n = 38$) were asked to identify where they shopped for food and what percentage of their total food came from each of those sources. The options ranged from their personal farm or garden to grocery stores as indicated in Table 8. After identifying which sources were used, farmers were asked whether they got all, most, some, or none of their food from each of those sources. Thirty nine percent of farmers report that they get most or all of their food from their farm or garden, while over 55.0% shopped for some of their food at local grocery stores. There were 14 farmers (36.8%) who reported they got none of their food from farmers markets or other local producers.

Table 9

Food Sources of Smallholder Farmers (n = 38)

Consumption	Own Farm/Garden		Grocery Store		Farmer's Market		Local Producers		Other	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	2	5.3	0	0.0	0	36.8	0	0.0	0	0.0
Most	12	31.6	11	28.9	3	7.9	2	5.30	0	0.0
Some	21	55.3	21	55.3	20	52.6	21	55.30	0	0.0
None	3	7.39	5	13.2	14	36.8	14	36.80	38	100.0

Farmers were asked to identify why types of foods they purchased from each of these sources. As shown in Table 10, the grocery store is the preferred source for purchasing protein with 34.2% of the farmers reporting they purchased all or most of their protein from the grocery store and another 48.6% indicating some of the protein is purchased there. Protein was also purchased at the farmer's market by 16.6% while 22.7% of the farmers purchased protein from local producers. The same purchasing pattern is found with dairy products. Almost half of the farmers (48.6%) reported purchasing all or most of the dairy products from the local grocery store. There were a few farmers who purchased breads/grains from local producers or the farmer's market, but largely breads/grains are purchased from the grocery story by 40.0% all or

most of the time. With 22.9% reporting not purchasing breads/grains at the grocery store and 60-77% not purchasing from the farmer's market or local producers, bread may be made at home. Fruits and vegetables were purchased the least overall with some purchases at the grocery store, farmer's market, and local producers.

Table 10

Food Group Purchasing Behaviors of Farmers

Purchased at Grocery Store (n = 35)

	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	6	17.1	11	31.4	4	11.4	0	0.0
Most	6	17.1	6	17.1	10	28.6	3	8.6
Some	17	48.6	8	22.9	13	28.9	18	51.4
None	6	17.1	10	28.6	8	22.9	14	40.0
Total	35	100.0	35	100.0	35	100.0	35	100.0

Purchased at Farmer's Market (n = 30)

	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	1	3.3	0	0.0	0	0.0	0	0.0
Most	4	13.3	2	6.7	1	3.3	3	10.0
Some	8	26.7	3	10.0	6	20.0	16	53.3
None	17	56.7	25	83.3	23	76.7	10	33.3
Total	30	100.0	30	100.0	30	100.0	30	100.0

Purchased from Local Producers (n = 22)

	Protein		Dairy		Breads/Grains		Fruits/Veggies	
Type	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
All	1	4.5	0	0.00	0	0.0	0	0.00
Most	4	18.2	0	0.00	0	0.0	1	4.5
Some	7	31.8	5	22.7	9	41.0	11	50.0
None	10	45.5	17	77.3	13	59.0	10	45.5
Total	22	100.0	22	100.0	22	100.0	22	100.0

To assess food insecurity prevalence rates, all respondents were asked whether in the last 12 months a lack of money or other resources meant they were unable to eat enough food or healthy food, ran out of food, were forced to cut portions or skip meals altogether, or were

hungry but did not eat. The response to eight questions positions the respondent on the Food Insecurity Experience Scale (FIES) from mild to severe food insecurity. The “yes” or “no” response of each of the eight questions of the FIES scale was totaled and shown in Table 11. In general, both the farmer and general public respondents have individuals who were experiencing some level of food insecurity. Some 11-18 farmers have none or little food insecurity reporting ‘no’ to the food insecurity experience questions. However, 4-11 of the farmers and 5-18 of the general public respondents answered ‘yes’ to different questions ranging from mild to severe levels of food insecurity experiences.

Table 11

Global Food Insecurity Experience Scale Questions and Response Totals

GLOBAL FOOD INSECURITY EXPERIENCE SCALE “During the last 12 MONTHS, was there a time when:”				
	<u>Farmers</u>		<u>Public</u>	
	No	Yes	No	Yes
Q1. You were worried you would not have enough food to eat because of a lack of money or other resources?	14	8	22	16
Q2. Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?	15	7	20	18
Q3. You ate only a few kinds of foods because of a lack of money or other resources?	11	11	23	15
Q4. You had to skip a meal because there was not enough money or other resources to get food?	14	8	33	5
Q5. Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?	14	8	28	10
Q6. Your household ran out of food because of a lack of money or other resources?	17	5	32	6
Q7. You were hungry but did not eat because there was not enough money or other resources for food?	18	4	33	5
Q8. You went without eating for a whole day because of a lack of money or other resources?	18	4	33	5

To determine the overall level of food insecurity, the raw score of each person on the FIES scale was summed for the farmers as well as the general public. The yes responses were totaled and averaged to produce an average raw score for each group of respondents. The average raw score for the farmer group was 2.1 with five farmers having a raw score above five

on the FIES scale (experiencing hunger) while 20 farmers had a raw score of four or less (worrying about food and compromising on quality and variety). There were 13 farmers who reported no problems with food insecurity. The five farmers with food insecurity problems represented 22.73% of the farmer sample. The average raw score of the general public was 2.5 with five individuals of the public having a raw score of five or above on the FIES scale (experiencing hunger) while eight public respondents had raw scores of less than four (worrying about food and compromising on quality and variety), and nine who reported no problems with food insecurity. These eight respondents represent 36.36% of the sample of the general public. While these differences are minimal, there are more respondents of the general public having food insecurity experiences.

The raw score totals of each question were plotted on the continuum of the FIES scale, and these totals are shown in Figure 2. To determine if the groups surveyed were different, a Chi Square test was utilized. The Chi Square test revealed a $\chi(1) = 3.79, p = .73$ therefore the groups were not different and comparisons could be made of the results gained.

Public								Avg. 2.5
9	2	3	2	1	0	0	3	2
<div> <div>Mild food insecurity</div> <div>Severe food insecurity</div> </div>								
<div> <div>Worrying about running out of food</div> <div>Compromising on quality and variety</div> <div>Reducing quantities, skipping meals</div> <div>Experiencing hunger</div> </div>								
13	6	5	6	3	2	0	0	3
Farmers								Avg. 2.1

Figure 2: Level of food insecurity from respondents based on raw score totals of questions from the FIES scale. Each cell represents the number of respondents for each raw score total category, i.e. 0-1, 2, 3, 4, 5, 6, 7, & 8 where 1 = mild food insecurity and 8 = severe food insecurity.

Objective 4: Determine community interest and opportunities for future small agricultural operations for farming and non-farming families

To assess how living in a historically agrarian region affects food consumption and access and to address Objective 4 of this study, general public respondents were asked to describe their exposure to agriculture. While living in an area where agriculture employs over twenty percent of the population and large-scale production occurs, when asked if they had any exposure to food production, 45.5% of the general public indicated that they had no exposure to agriculture, but almost 41.0% reported that they had at least some exposure. As a follow up, respondents were asked whether or not they had considered growing their own food for self-consumption, as well as for additional income. While 45.5% report they had considered growing food for additional income, a majority (54.5%) reported that they would consider growing food for self-consumption. Access to capital was reported as the number one reason for not producing their own foods reported by 91.3%, followed by the time (33.3%), and space required for production (53.3%).

Further, the public was asked if they would be willing to grow poultry. This question is central to a local community development initiative with Peacework International. Poultry production is a popular activity among residents in Stann Creek due to the corporate influx of poultry farms and retailers. Because poultry is a great source of protein, this question was important to understand what farmers are open to poultry production and how the Ministry of Agriculture or similar entities might assist in these efforts. Over half were not interested in raising backyard poultry, while 45.5% indicated they would be willing to raise poultry.

Since over two thirds of the farmers were interested in diversifying, as reported in objective two, the farmers were asked if they would consider producing poultry for consumption

or additional farm income. Slightly over 80.0% of the farmers ($n = 31$) reported they had considered growing poultry, but another 19.4% had no interest.

As an assessment to food security and the continuity of food production in the area as described in part by Objective 3, over 97.0% of the farmers ($n = 38$) reported they planned to continue their operations in the next five years.

Discussion and Recommendations

Regarding the first two objectives of this study which were exclusive to the population of farmers, it was important to understand what information sources are available to farmers, how farmers utilize those resources, and ultimately, how effective those resources are at improving the livelihood and productivity of farmers across the District of Stann Creek. The majority of the farmers in the study have crop operations, mostly rice production, and would consider diversifying if land and financial resources were not barriers. Many farmers reported they obtained information through the extension services but also contact fellow farmers and friends for agriculture-related assistance. Interestingly, from general observation and reports from participating farmers, the Ministry of Agriculture did not use an organized system for utilizing contact farmers. As noted in a study by Kipkurgat (2015), contact farmers are effective vehicles for disseminating information to rural farming communities because of the existing trust and lack of competition among farmers in homogenous regions. With this method being an effective form of transferring information from the most technical levels of production to the hands-on implementation of farm production practices, it is notable that Belize does not have such a system in place. I observed through various farm and cooperative visits that camaraderie was plentiful among fellow farmers. Furthermore, at almost every location, leaders emerged that had

the respect of their cooperative members and fellow farmers. These opinion leaders would be perfect points-of-contact for the Department of Agriculture in Stann Creek to utilize when sharing information in a way that is quick, effective, and applicable.

While access to extension workers and support remained a popular channel, farmers had varying opinions on the level of trust and helpfulness of this system as witnessed in the cooperative meetings. With a limited workforce and widespread areas, it is difficult for extension officers to make regular contact with every farmer and cooperative in Stann Creek. To combat this without hiring new employees or increasing the expenditures of the extension office, the Department of Agriculture could take advantage of the existing opportunities for building trust and establishing regular, reliable channels of communication. As Blait, Calvelo Rios, and Masias (1996) point out, the least expensive input for improved rural agricultural development is adequate access to knowledge and information. Implementing a system for contact farmers to help with the transfer of vital production information could be an effective way to make contact more consistent, thus increasing the relevancy of extension services. My observations were that the majority of farmers were still using traditional methods of agricultural production such as hand tilling, no irrigation, planting by hand, etc. Aside from the limited access to capital, if farmers have access to current trends and information regarding their operations, then they would be more apt to adopt such methods, providing a pathway for increased productivity and farming success. Regular communication that yields results will begin to build trust among farmers and extension officers.

Through various interviews and group discussion held while conducting this study, it was evident that most farmers, even those in the most remote areas, had access to cell phones and mobile broadband technology. Knowing this, the Department of Agriculture could utilize these

devices to get information to farmers in real time. Various other countries, such as India, employ mobile alerts for farmers throughout the entire country via extension programs. Without travelling to every farm every day, it is impossible for the experts to provide technical advice as farmers need it for every instance. However, with mobile technology, extension officers could equip farmers across Stann Creek with weather updates and warnings, current market prices, information on disease control, pest control, and other input-related information. Utilizing this channel of communication could create potential partnerships between private companies and the Department of Agriculture to get product-specific information to farmers, as necessary. These contact opportunities would likely increase farm productivity and build trust between the Department of Agriculture and smallholder farmers.

Many farmers in Stann Creek felt that data collection done by the local Department of Agriculture officials was unnecessary. At the beginning of survey administration, farmers expressed that data is often collected, but they never see benefits on their farm. With the age of information and documentation within government and private sector companies, it is important that extension officers, scientists, consumers, and producers have sufficient access to updated information that allows them to make informed decisions about their operations. As noted in the findings of this study, the majority of farmers in Stann Creek are educated, receiving at least a primary school education allowing them to read and write. It appeared through further observation and group discussion that there is disconnect between the Agriculture Department's perception of farmer literacy and the actual ability of these farmers to comprehend and utilize information to their benefit. To mitigate the distrust regarding data collection and applicability on the farm, the extension service in Belize could expand training opportunities to equip farmers with the skills needed to analyze soil profiles, use weather predictions, and other technical

factors affecting their farm operations. These farmers appear to be willing to adapt their practices to best methods but required evidence of increased production potential.

Furthermore, utilizing local farmers' capacity for utilizing available information should become a focus for extension officers across Stann Creek to accomplish their goals. With farmers having access to cell phones and the Internet, the Department of Agriculture could provide relevant information on a regular basis. Despite the Agriculture Department's regular contact with farmers in the District, the applicability of the information that is provided to them is limited or does not fully address their current needs and concerns. Over 70.0% of farmers claim that they have not used any new technology on their farm within the last 10 years. For the farmers that had, they learned about the new technology they are now using from media outlets—not the extension service. In fact, only five percent report that they had learned of new production technology because of their extension agent. Spreading information about new technologies is often done through strategies such as demonstrations, field visits, farmers' meetings, and use of media. This finding corresponds to the results found by Tripathy and Panday (1967). All of these strategies could serve as a framework for how the Stann Creek Agriculture Department can more effectively communicate with smallholder farmers to meet their needs. As noted in several studies, access to information and technology are vital for rural development and thus, promoting food security and access.

The majority of smallholder farmers in Stann Creek owned row crop operations, while 35.1% reported operations with both row crops and animal agriculture. It seemed that most farmers grew similar commodities because of their lack of local competition. With the infiltration of foreign-owned supermarkets in the area, the consuming public is obtaining their food from grocery stores at a higher rate than from local producers. Therefore, local farmers can

produce the same products and still access export markets, elsewhere. This phenomenon should highlight the Agriculture Departments opportunity to expand their reach beyond just local producers and begin communicating with the general public to expand market access for their producers and build a connected food system within Stann Creek at the local level. Extension models, such as the one instituted in the United States, focuses on the food system starting on the farm and ending on the plate of consumers. With a focus on such a model in Belize, it is likely that consumers could be an excellent market for local producers when choosing to whom and where they want to sell their products. Furthermore, this could have major implications for food access and security throughout the entire region. Farmers are interested in expanding their operations, so connecting them to consumer demands could be highly beneficial. For farmers that were not interested in diversifying and expanding their farms, they report access to capital as being the biggest barrier keeping them from doing so. If the agriculture department continued its education topics beyond the farm to include farm business management, record keeping, and options to expand access to capital, farmers in Stann Creek would be better prepared to meet consumer demands locally and within global markets.

Positively, despite the concerns and barriers of farmers, over 97.0% of farmers in this study planned to continue farming within the next five years. This is promising for the local economy, as well as food security concerns in the district.

As part of the food security assessment portion of the study, both farmers and the general population were asked where they obtain food products. Overwhelmingly, both groups report getting the majority of their dairy, grains, meats, and produce from supermarkets and local grocery chains. A vast majority indicated that they purchased some or none of their total grocery from local producers. This discovery raises further questions as to why Stann Creek locals

depend on foreign retailers to provide their food when local producers are available near most major communities and villages. For the general population, it appears that access to healthy foods such as protein products and fresh fruits and vegetables were not of major concern. With food access closely tied to proximity to grocery stores and other food retailers (FAO), it is interesting that both smallholder farmers and the general public report live less than one mile from a food retailer even though national statistics suggest that the country, as a whole, is off target at eradicating extreme hunger and reducing food insecurity (FAO). The limitations of financial resources should be investigated further. Additionally, the majority of the public reported that they would be willing to grow poultry and produce for self-consumption, but not for additional income. This seems to be a reflection of their current state of food access and availability. The respondents are willing to grow food to feed their families, while they are not yet able to raise excess foods to sell. Space and time were reported as the main reasons for not producing their own foods.

With the FIES, I was able to determine how food insecure both the general public and the smallholder farmers might be based on the perception of food access and the actual level of access these groups reported in previous questions of the study. Intuitively, one might conclude that farmers have easier (and greater) access to fresh foods of all varieties, depending on regionality of production. However, the results of this study showed a marginal difference between the two groups regarding food insecurity. The average raw score for the farmer group was 2.1 meaning that they experience hunger or have in the last 12 months. Almost two-thirds of the farmers indicated some level of food insecurity while one-third reported no problems with food insecurity because most of their family's food is consumed straight from their farm or they have the resources to secure food. However, almost 23.0% of the sample of smallholder farmers

indicated they were food insecure. This statistic supports the United Nation's findings that the country is, in fact, off target at eradicating hunger and reaching their first MDG.

Similar to that of the farmer group, the general public reported an average raw score of 2.5 showing those respondents had experienced hunger, as described by the FAO, within the last year. Although the difference is marginal and not significant between the farmer and general public group, it is logical that the general public—the individuals who are most removed from fresh food sources and agricultural production—would experience food insecurity when compared to the smallholder farmer group. The respondents that were identified as having experienced or are experiencing food insecurity represent 36.4% of the general public sample. While both groups are experiencing food insecurity, there are more respondents of the general public having food insecurity experiences. Since instances of food insecurity do exist, I think that it is important for local producers to be connected to local consumers. Similarly, it is even more important that local consumers know they have access to fresh, affordable protein and produce because of their proximity to local producers.

The Agriculture Department and Belize Ministry of Agriculture could consider expanding educational outreach initiatives to reach those consumers and build even more market access for the smallholder farmers in Stann Creek and beyond. By emphasizing the importance of nutritional quality and local food access, agriculture workers and government officials should consider promoting a more localized food system and provide realistic alternatives for attaining enough food to live a healthy and active lifestyle. According to Chen et al. (2009), bridging food insecurity with an increased opportunity for local production has real potential to alleviate hunger and improve the quality of life of numerous people. Future research should be done to better understand the local food system and analyze the disconnect between local markets and

producers. Furthermore, additional research is needed to understand why farmers have experienced a decrease in productivity over recent years so that these barriers can be addressed, as needed.

Limitations of this study included the sample size, method of sampling, and lack of the observations to help explain the context of citizens living in Belize. With convenience sampling of the general public and farmers, these findings cannot be generalized to the population of Belize. It was hard to determine how accurate the responses were given considering the vast differences in cultural backgrounds, age, sex, and education levels. Furthermore, because the questions about food insecurity require sensitive information, it is likely that the study included some response bias from participants that felt uncomfortable revealing their level of economic stability. With the respondents from the farmer group, it is possible that participating farmers were not fully representative of all farmers in the region. The farmers that attended the meetings arranged by Peacework and extension officers were likely more progressive producers being that they were easily contacted and readily agreed to provide feedback for the study. It is likely that the values of the researcher influenced the interpretation of the findings, observations, or statements made by the respondents.

References

- Aonngerthayakorn, K., & Pongquan, S. (2016). Determinants of rice farmers' utilization of agricultural information in Central Thailand. *Journal of Agricultural & Food Information, 18*(1), 25-43. doi:10.1080/10496505.2016.1247001
- Agriculture Department. (n.d.). Retrieved April 03, 2017, from http://www.agriculture.gov.bz/Agriculture_Dept.html
- Balit, S., Calvelo Rios, M. & Masias, L. (1996). Communication for development for Latin America: a regional experience. FAO, Rome, Italy.
- Caribbean Agricultural Research and Development Institute (CARDI). (n.d.). Belize. Retrieved April 03, 2017, from <http://www.cardi.org/country-offices/belize>
- Cook, J. T., & Frank, D. A. (2008, July 25). Food Security, Poverty, and Human Development in the United States. Retrieved March 28, 2018, from <https://nyaspubs.onlinelibrary.wiley.com/doi/abs/10.1196/annals.1425.001>
- Dutta, R. (2009). Information needs and information-seeking behavior in developing countries: A review of the research. *The International Information and Library Review, 41*. 44-51. 10.1080/10572317.2009.10762796.
- FAO. (n.d.). Reducing poverty and hunger: The critical role of financing for food and agriculture. Retrieved April 03, 2017 from <http://www.fao.org/docrep/003/Y6265E/y6265e03.htm>
- FAO (2017). The food insecurity experience scale. Food and Agriculture Organization of the United Nations. Retrieved April 4 2018 from <http://www.fao.org/3/a-i7835e.pdf>
- Frankenberger, T., 1996. Measuring household livelihood security: an approach for reducing absolute poverty. *Food Forum 34* (November-December). Food Aid Management, Washington, D.C. 1-6.
- Godfray, H. J., Beddington, J. R., Crute, I. R., Haddad, L., D. L., Muir, J., Toulmin, C. (2010, February 12). Food Security: The Challenge of Feeding 9 Billion People. *Science*. Retrieved March 12, 2018 from <http://science.sciencemag.org/content/327/5967/812.full>
- Kipkurgat, T. (2015). Agricultural extension services for dairy farmers in Wareng District, Kenya. *International Journal of Advanced Research, 3*(3), 273-282.
- Maxwell, D.G., (1996). Measuring food insecurity: the frequency and severity of coping strategies. *Food Policy 21*(33), 291-303. MDG Monitor. (2016, September 15). Fact sheet on current MDG progress of Belize. Retrieved April 04, 2017, from <http://www.mdgmonitor.org/mdg-progress-belize-latin-america-caribbean/>

- Munuya, H. (200). Application of information communication technologies in the agricultural sector in Africa: a gender perspective. In Rathgeber, E. & Adera, E.O. (Eds). *Gender and information revolution in Africa* IDRC/ECA.
- Nxumalo, K. K. S. and Oladele, I. O. (2013). Factors affecting farmers' participation in agricultural programme in Zululand District, Kwazulu Natal Province, South Africa. *Journal of Social Sciences*, 34(1), 83-88.
- Obidike, N. A. (2011). Rural farmers' problems accessing agricultural information: A case study of Nsukka local government area of Enugu State, Nigeria. *Library Philosophy & Practice*, 76. Retrieved April 03, 2017.
- Ogunleye, K. Y., & Abidogun, O. G. (2014). Analysis of market information sources for agricultural transformation among cassava farmers in Moro local government area of Kwara State, Nigeria. *Journal of Agricultural & Food Information*, 15(2), 136-143. doi:10.1080/10496505.2014.891459
- Rajaguru, G.S. & Satapathy, C. (1971). Effectiveness of sources of information in the adoption of high yielding varieties by the farmers of the Puri District of Orissa. *Indian Journal of Extension Education*. 7(1), 88-89.
- Rural Poverty in Belize. *Rural Poverty Portal*. N.p., 2017. Web. 4 Apr. 2017.
- Smith, L. C., El Obeid, A. E. and Jensen, H. H. (2000), The geography and causes of food insecurity in developing countries. *Agricultural Economics*, 22: 199-215. doi:10.1111/j.1574-0862.2000.tb00018.x
- Statistic of The Nation". *Sib.org.bz*. N.p., 2017. Web. 4 Apr. 2017.
- United Nations Development Programme. (n.d.). About Belize. Retrieved April 03, 2017 from <http://www.bz.undp.org/content/belize/en/home/countryinfo.html>
- Van, C., & Fortier, F (2000). National Agricultural and Rural Knowledge and Information System (NARKIS): a proposed component of the Uganda National Agricultural Advisory Service (NAADS). FAO, Rome, Italy.
- World Development Report 2008: Agriculture for Development. (n.d.). Retrieved June 2, 2017.
- World Food Programme (2015). Country Capacity Strengthening. Retrieved April 4, 2018. <http://www1.wfp.org/country-capacity-strengthening> Retrieved April 4, 2018.
- Zelaya, P., Harder, A., & Roberts, T. G. (2016). Small-Scale Farmers' Perceptions of agricultural information sources in Northern Haiti. *Journal of International Agricultural and Extension Education*, 23 (Summer 2016). Retrieved March 29, 2018.

Appendices

Appendix I: IRB Approval



UNIVERSITY OF
ARKANSAS

May 26, 2017

MEMORANDUM

TO: Sam Harr

Office of Research Compliance
Institutional Review Board

Donna Graham

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 17-05-691

Protocol Title: *Agricultural Information Needs and Food Access in Belize*

Review Type: ☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB

Approved Project Period: Start Date: 05/26/2017 Expiration Date: 05/25/2018

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<https://vpred.uark.edu/units/rscp/index.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 50 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

Appendix II: Farmer Questionnaire

I'm Sam Harris, I'm currently a student at the University of Arkansas which is in the southern part of the United States. At the U of A, I am studying agricultural business and leadership. I'm mainly interested in food security and discovering why hunger exists in all parts of the world. Through my college, I have the chance to travel to Belize to spend the summer learning about agriculture and how families produce and consume food across the region and that's why I am here today. I would like to ask you some questions about the farming operation and the information sources used. Your answers will be completely confidential without any identification tied to you. This should last about 15 minutes. Would you agree to answer the questions?

General Information:

- 1. How long have you been farming? (years)**
- 2. Have you always lived in the Dangriga-area? If no, where did you grow up?**
- 3. In hectares, how large is your operation?**
- 4. What type of farming operation do you have?**
Crops? Go to 3a Animals? Go to 3b
 - a. If crops, what type of crop do you produce?**
 - b. If animal, what type of animal production?**
 - c. Have you even considered diversifying? Yes or No**
 - d. What barriers keep you from expanding?**
 - e. {If poultry is not given in 3b}, ask Have you ever considered raising poultry on your farm? Yes or No**
- 5. Do you depend on your crop or livestock operation for your total source of income for the family? Yes or NO**

If no, what other sources of income does your family have?
- 6. How did you learn to produce _____ (crops/livestock identified)?**
- 7. What is your main concern associated with {crop or livestock} production on your farm?**
Examples if needed: Insect damage, Diseases, Poor yield, Weather

8. Do you seek information to help solve these problems or help improve your farm productivity?

Yes, go to Q8

NO, go to Q11

9. What information sources do you use for agricultural production? Check all that are identified.

- | | |
|---|---------------------------------------|
| a. Radio | h. Other governmental agencies |
| b. Television | i. Non-governmental agencies |
| c. Leaflets, pamphlets | j. Friends |
| d. Newsletters | k. Family members, like parents |
| e. Internet | l. Input Service providers |
| f. Extension workers or extension training meetings | m. Schools |
| g. Library | n. Other |
| | o. None, rely on personal experiences |

10. How often do you consult these sources for agricultural production information? Ask only for sources Identified in Q8.

	Daily (D)	Weekly (W)	Monthly (M)	Seasonally (S)
a. Radio	D	W	M	S
b. Television	D	W	M	S
c. Leaflets	D	W	M	S
d. Newsletters	D	W	M	S
e. Internet	D	W	M	S
f. Extension workers	D	W	M	S
g. Extension training meetings	D	W	M	S
h. Library	D	W	M	S
i. Other governmental agencies	D	W	M	S
j. Friends	D	W	M	S
k. Family members, like parents	D	W	M	S
l. Service providers	D	W	M	S
m. Rely on personal experiences	D	W	M	S

11. What problems have you encountered in using these sources (identified in Q9)?

(Possible answers include)

- | | |
|---|---|
| a. Poor radio or television signals | f. Lack of rural electricity |
| b. Agricultural information that airs on radio or television is always aired at odd hours | g. Electrical power interruptions |
| c. Lack of access to extension workers | h. Lack of money to purchase agricultural information |
| d. Agricultural information is not broadcast on radio or television | i. Not in same political movement |
| e. Inability to read or write | j. Lack of trust in the source |

Farm Stability:

12. **Have you started using new technologies on your farming operation within the last 10 years?** (Irrigation, enhanced seed varieties...etc.) Yes or No.
12. ***How did you learn about this new technology?***
13. **Have you seen an increase or decrease in production on your farm in the last 5 years?**
14. **What do you contribute the increase (or decrease) of production to?** (Adopting new technology, climate change, lack of information, production costs, etc.)
14. **Do you plan to continue farming in the next 5 years?**
15. **Who will take over your land/farm when you stop farming?**
16. **Do you have children that plan to farm?**
a. If not, what are their career plans?

Food Security & Access:

17. **Considering all food sources in your area, how much food do you get for your family from...?**

- | | | | | |
|--------------------|-----|------|------|------|
| a. Own farm/garden | All | Most | Some | None |
| b. Grocery Store | All | Most | Some | None |
| c. Farmer's Market | All | Most | Some | None |
| d. Local Producers | All | Most | Some | None |
| e. Other _____ | All | Most | Some | None |

18. **Now I want to ask about the type of food items you purchase at the grocery store? Please answer with whether you purchase all, most, some or none of these foods from the grocery store. {will have list of examples}**

- | | | | | |
|-----------------------|-----|------|------|------|
| a. protein foods | All | Most | Some | None |
| b. dairy foods | All | Most | Some | None |
| c. bread/grains | All | Most | Some | None |
| d. fruits/vegetables? | All | Most | Some | None |

19. {Skip if the answer is none in 17c.

Considering your purchases at the farmers market, what type of food items do you purchase at the farmer's market? Please answer with whether you purchase all, most, some or none of these foods from the farmer's market.

- | | | | | |
|-----------------------------------|-----|------|------|------|
| a. protein foods (chicken, beef,) | All | Most | Some | None |
| b. dairy foods (milk, cheese,) | All | Most | Some | None |
| c. bread/grains , | All | Most | Some | None |
| d. fruits/vegetables? | All | Most | Some | None |

20. {Skip if answer is none in 17d}

What type of food do you purchase from local producers?

- | | | | | |
|-----------------------------------|-----|------|------|------|
| a. protein foods (chicken, beef,) | All | Most | Some | None |
| b. dairy foods (milk, cheese,) | All | Most | Some | None |
| c. bread/grains , | All | Most | Some | None |
| d. fruits/vegetables? | All | Most | Some | None |

21. Now, I would like to ask some questions about your food consumption in the last 12 months. These questions will allow me to understand what food security is like in Belize. Remember, all of these responses will remain anonymous. By answering yes or no, during the last 12 months,

1. Have you been worried you would run out of food because of a lack of money or other resources? **Y or N**
2. Were you not able to purchase healthy foods such as vegetables, fruits, proteins, etc. because of a lack of money or other resources? **Y or N**
3. Have you eaten only a few kinds of foods because of a lack of money or other resources? **Y or N**
4. Have you skipped a meal because there was not enough money or other resources to purchase food at the market? **Y or N**
5. Have you eaten less than you thought you should because of a lack of money or other resources? **Y or N**
6. Has your household ran out of food because of a lack of money or other resources? **Y or N**
7. Have you been hungry but did not eat because there was not enough money for food? **Y or N**
8. Have you went without eating for a whole day because of a lack of money or other resources? **Y or N**

22. How many people live in your household?
23. What is your highest level of education?
24. What is your age?
25. Gender: Male or Female

GLOBAL FOOD INSECURITY EXPERIENCE SCALE		
Now I would like to ask you some questions about food. During the last 12 MONTHS, was there a time when:		
	YES	NO
Q1. You were worried you would not have enough food to eat because of a lack of money or other resources?		
Q2. Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?		
Q3. You ate only a few kinds of foods because of a lack of money or other resources?		
Q4. You had to skip a meal because there was not enough money or other resources to get food?		
Q5. Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?		
Q6. Your household ran out of food because of a lack of money or other resources?		
Q7. You were hungry but did not eat because there was not enough money or other resources for food?		
Q8. You went without eating for a whole day because of a lack of money or other resources?		

Appendix III: General Public Questionnaire

I'm Sam Harris, I'm currently a student at the University of Arkansas which is in the Southern part of the United States. At the U of A, I am studying agricultural business and leadership. I'm mainly interested in food security in all parts of the world. Through my university, I have the chance to travel to Belize to spend the summer here learning about agriculture and how families produce and consume food across the region. I would like to learn about the way you obtain food and your answers to food security. This will take about 10 minutes. Would you participate?

General Information:

Warm-up questions: Please tell us about yourself.

Tell me about your family? Clarify how many are in the family.

How long have you and your family lived in Stann Creek?

What exposure have you had to agriculture?

Who has primary responsibility to shop for food in the family?

On average, how many meals does your family consume a day?

Food Availability

1. **Considering all sources of food in this area, where do you get your food? Please answer all sources by indicating whether you get all, most, some or none from each source.**

- | | | | | |
|--------------------|-----|------|------|------|
| a. Grocery stores | All | Most | Some | None |
| b. Farmer's Market | All | Most | Some | None |
| c. Local Producers | All | Most | Some | None |
| d. Other _____ | All | Most | Some | None |

2. **In kilometers, how far is it to the nearest grocery store, _____ farmer's market _____? Local producer? _____**

3. **Now I want to ask about the type of food items you purchase at the grocery store? Please answer with whether you purchase all, most, some or none of these foods from the grocery store.**

- | | | | | |
|-----------------------------------|-----|------|------|------|
| a. protein foods (chicken, beef,) | All | Most | Some | None |
| b. dairy foods (milk, cheese,) | All | Most | Some | None |
| c. bread/grains , | All | Most | Some | None |
| d. fruits/vegetables | All | Most | Some | None |

4. **{Skip if the answer is none in 1b.}**

Considering your purchases at the farmers market, what type of food items do you purchase at the farmer's market? Please answer with whether you purchase all, most, some or none of these foods from the farmer's market.

- | | | | | |
|-----------------------------------|-----|------|------|------|
| a. protein foods (chicken, beef,) | All | Most | Some | None |
| b. dairy foods (milk, cheese,) | All | Most | Some | None |
| c. bread/grains , | All | Most | Some | None |
| d. fruits/vegetables? | All | Most | Some | None |

5. {Skip if the answer is none in 1c.}

What type of food do you purchase from local producers?

- | | | | | |
|-----------------------------------|-----|------|------|------|
| a. protein foods (chicken, beef,) | All | Most | Some | None |
| b. dairy foods (milk, cheese,) | All | Most | Some | None |
| c. bread/grains , | All | Most | Some | None |
| d. fruits/vegetables? | All | Most | Some | None |

6. Is meat protein available to eat at least once a day? Yes or No

7. Are fruits/vegetables available to eat at least once a day? Yes or No

8. Do you currently produce any food to eat? If yes, go to 8a. If no, go to 9

- a. What do you produce?
- b. How much of _____ do you eat?
All Most Some None
- c. Do you sell any _____? If yes, how much?
All Most Some None

(Repeat for each crop/livestock produced)

9. Would you consider growing some of your own food? Yes or No. If no, go to 10

- a. If yes, what would you like to grow? _____
 - i. For additional income? **Y or N**
 - ii. For self-consumption? **Y or N**
- b. Would you consider raising backyard poultry?
 - i. For additional income? **Y or N**
 - ii. For self-consumption? **Y or N**

10. What keeps you or would keep you from producing your own food?

11. What is your main source of income?

12. What is your highest level of education?

13. What is your age?

14. Gender: Male or Female

Food Security Evaluation:

Now, I would like to ask some questions about your food consumption in the last year. By answering yes or no, during the last 12 months, was there a time when:

1. Due to a lack of money, you did not purchase:
 - a. Protein? Yes or No
 - i. If yes, how often did you go without protein? N D W M
 - b. Fruits/Vegetables? Yes or No
 - i. If yes, how often did you go without fruits/Vegetables? N D W M
 - c. Breads/Grains? Yes or No
 - i. If yes, how often did you go without breads/grains? N D W M
 - d. Dairy? Yes or No
 - i. If yes, how often did you go without dairy? N D W M
3. Due to a lack of availability, you did not purchase
 - a. Protein? Yes or No
 - i. If yes, how often did you go without protein? N D W M
 - b. Fruit/vegetables? Yes or No
 - i. If yes, how often did you go without protein? N D W M
 - c. Bread/grains? Yes or No
 - i. If yes, how often did you go without protein? N D W M
 - d. Dairy Yes or No
 - i. If yes, how often did you go without protein? N D W M

During the last 12 months,

9. Have you been worried you would run out of food because of a lack of money or other resources? **Y or N**
10. Were you not able to purchase healthy foods such as vegetables, fruits, proteins, etc. because of a lack of money or other resources? **Y or N**
11. Have you eaten only a few kinds of foods because of a lack of money or other resources? **Y or N**
12. Have you skipped a meal because there was not enough money or other resources to purchase food at the market? **Y or N**

13. Have you eaten less than you thought you should because of a lack of money or other resources? **Y or N**
14. Has your household ran out of food because of a lack of money or other resources?
Y or N
15. Have you been hungry but did not eat because there was not enough money for food? **Y or N**
16. Have you gone without eating for a whole day because of a lack of money or other resources? **Y or N**